CAR PARK ALLOCATION SYSTEM

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Abstract— **This Car Park Allocation System is the parking systems that allocate car automatically by the embedded system that consist of microcontroller. This project is to make easier for drivers to allocate their car in the parking lot. It also reduces time for search parking lot available. Besides that, the parking space area can be and further reducing the land and material cost for the parking areas especially in the crowded area like Kuala Lumpur, Penang and Johor Baharu. This parking system is suitable for the crowded areas especially shopping complex, apartments and campus. This project use PIC16F877A as a microcontroller where consists of five I/O ports. In this project, port A, B, D and E is defined as input port while port C is define as output port. This system programming was design by using Microchip MPLAB® IDE v8.20. HI-TECH C® compilers use as C compilers.**

Keyword— **microcontroller**

1.0 INTRODUCTION

Parking lots are defined as one or more level of cleared areas which is for parking vehicles. Parking lots also cause some problems. According to Road Transport Department Official Malaysia, the number of new vehicles was registered in 2007 is 1,023,211 where Wilayah Persekutuan is the highest rank which is 258,205 followed by Johor, Penang, Selangor and others. In 2007, the number of vehicles registered increased 5.32% [1].

The increasing of vehicles cause a problems occur at the parking area especially lack of parking space. Cities like Kuala Lumpur, Penang and Johor Baharu faced problem with the lack of parking space especially at the shopping complex, office building, apartments and campus area. The government or construction companies that involve with construction of these buildings face a problem of lands space.

Besides that, problems may occur at parking areas. One of the problems is an accident by careless drivers.

Another problem occurs are conflicts of using the same parking spots at the same time. This will cause conflicts and fighting. The parking wars also occur when a driver pays monthly fee for a particular reserved parking spot and someone else used it. Besides, drivers can also get stressed while spending hours looking for parking spot especially at crowded areas. This will cause double parking by irresponsible drivers.

Figure 1: A car park in double parking.

The objective of this project Car park Allocation System is to solve parking problems. The system can reduce and save parking space area and land cost. This is because the project is design to locate vehicles using multi level parking building. The government or construction companies can solve the parking issues for their buildings and also reduce or maintain their land cost.

Besides that, this will reduce time to allocate and reallocate car to or from parking lot and also avoid stresses occur among the drivers. Accident can also be avoided because all process of parking a car totally control by the systems.

Using the system, drivers do not have to find a parking lot to park their car. They just have to select parking lot available from the monitor at the entrance and the system will automatically park the car for them.

2.0 LITERATURE REVIEW

This project study involved software and hardware studies. First studies are focused on the application of microcontroller. These are the studies of the characteristics, input and output configurations pins, and analog and digital ports of the microcontroller. This project studies are focused on PIC16F877A.

Second studies are focused on the programming application using C language. This focused on how to programming input and outputs for the microcontroller. It also included the studies of analog and digital configuration of this microcontroller. Besides that, these studies also focused on hardware parts which are focused on basic needs of the microcontroller to operate.

Third studies are focused on hardware design. This part focused on how to design the schematics circuit and circuit layout of this project. It also focused on the mechanical designs on how to build a model for the parking system.

3.0 METHODOLOGY

This project use PIC16F877A as a microcontroller where consists of five I/O ports. In this project, port A, B and D is define as input port while port C is define as output port. The operating frequency of this PIC16F877A is 20MHz

which was supplied by crystal oscillator. This PIC also required 5V VDD to operate.

The circuit diagram was design by using TINA software. The schematics diagram is shown in Figure 7.

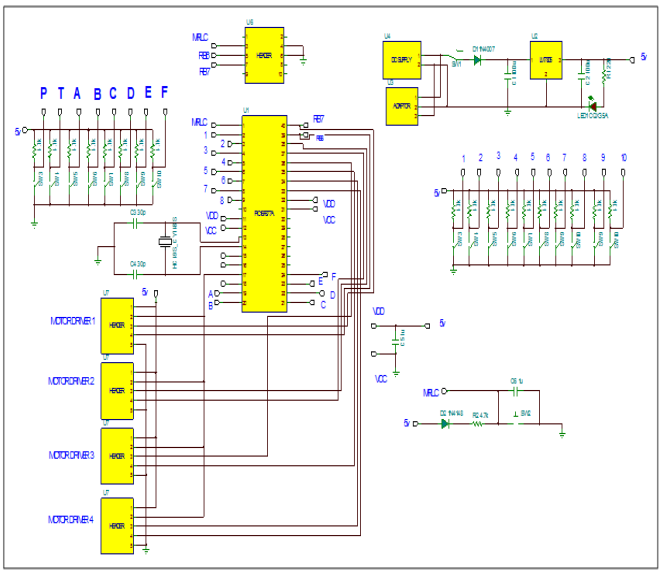


Figure 7: Schematics circuit

The inputs of this microcontroller are switches. There have two part of inputs switches. First parts are the switches which defined as selection buttons. The selection buttons are defines as shown in Figure 8. The selections buttons was setup as port A of PIC16F877A.

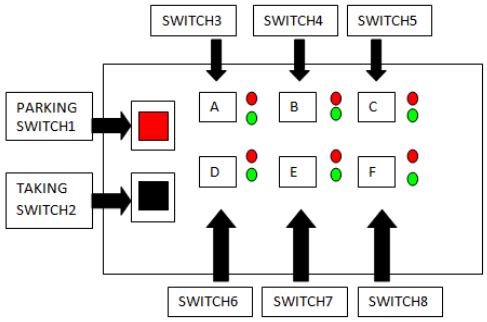


Figure 8: Switches define for display board

Second part of the switches was defined as sensors for motors movements. There are also the inputs for the PIC16F877A. Port B and D of the PIC16F877A were used for these inputs. The inputs are shown as Figure 9.

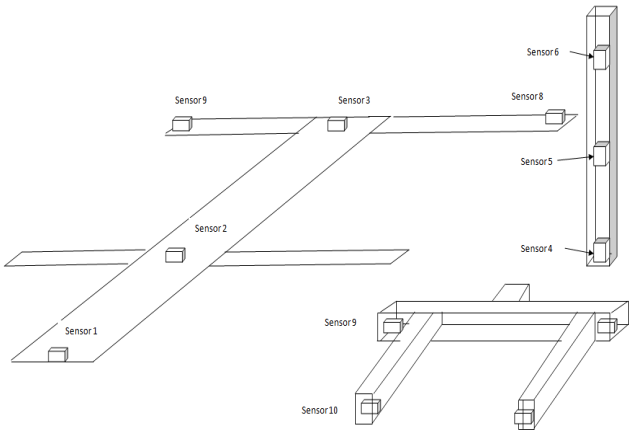


Figure 9: Switches as sensors

The output of the microcontroller is the movements of DC motors. Port C was defined as outputs. There have four DC motors in this system which powered by 12V.

Each motor is used for different process. Motor4 is used to clip or released the car.

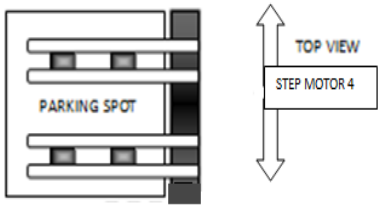


Figure 10: Motor4 operation

Motor1 operate in y axis to define the column of the parking spot.

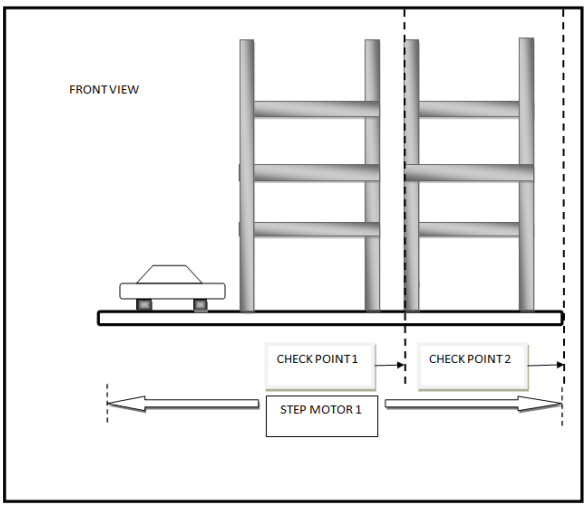


Figure 11: Motor1 operation

Motor2 operate in up and down direction to define the level of the parking spot.

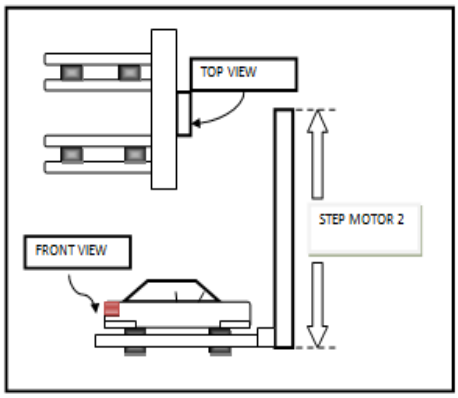


Figure 12: Motor2 operation

The motor3 operate in x axis. Motor3 also act as to define the row of the parking spot.

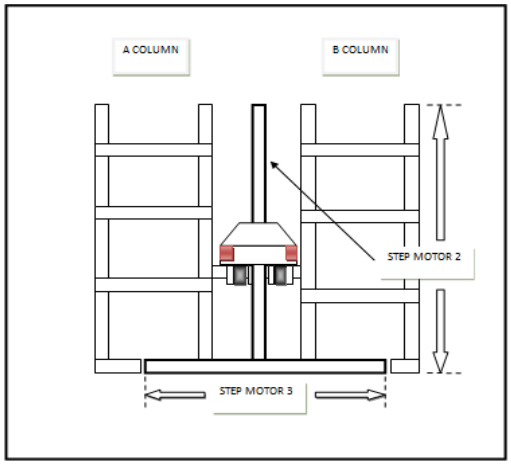


Figure 13: Motor3 operation

The system programming of this project was designed base on the flow chart. This system programming was design by using Microchip MPLAB® IDE v8.20 with HI-TECH C® compilers. MPLAB IDE is a software programming to provide a development environment for embedded microcontroller design. This programming was design and compile in C programming using HI-TECH C® compilers. Using the C programming syntax language is easier ways to programming microcontroller (PIC). This is because C programming offers unmatched power and flexibility in programming microcontrollers.

The system programming of this project was design base on the flow chart shown as Figure 14 and Figure 15. Flow chart in figure 14 shown the switches use to define drivers wants whether for allocate and reallocate car to or from chosen parking lot. Flow chart for Figure 15 shown for motors operates for allocate or reallocate the car to or from the chosen parking lot after defined by drivers from display board.

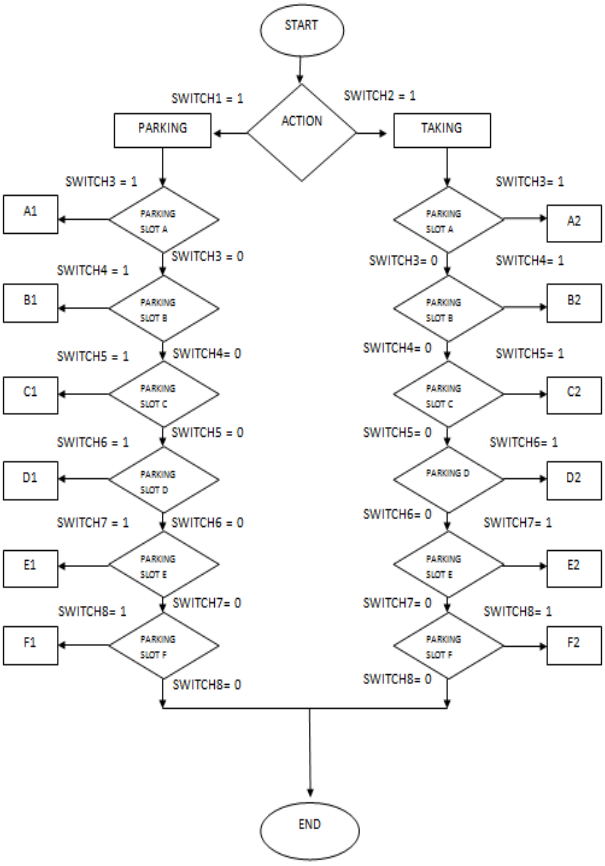
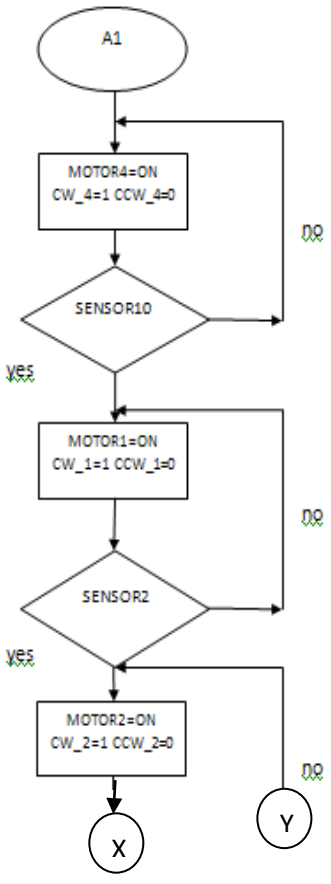
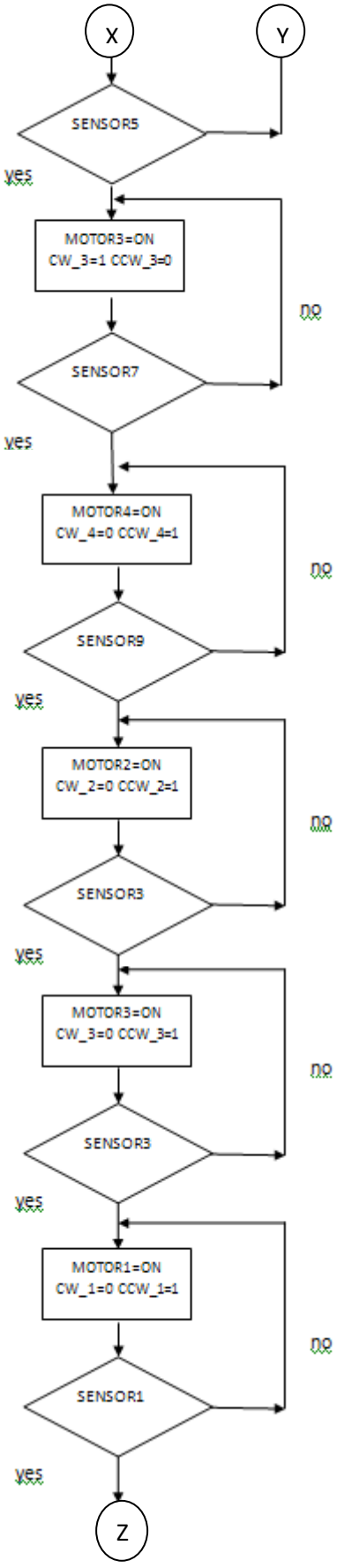


Figure 14: Design flow chart of display process





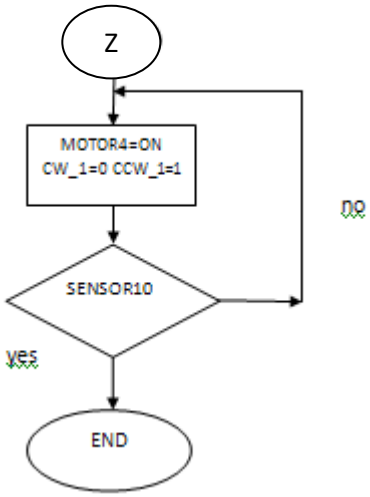


Figure 15: Design flow charts of process for motors operate define by sensors.

4.0 RESULT AND DISCUSSION

There are two actions which are for allocate or reallocate the car to or from the chosen parking lot. For each parking lot there are similar processes but only different of input switches and sensors to define which motor will run and stop. Result below shown for process of parking A while to parking car into this parking spot or taking back a car from this parking spot.

a) PARKING CAR AT PARKING LOT A

Table1: Parking Car at Parking lot A

Input												output								DESCRIPTION
user		sensor										M1		M2		M3		M4		
SWP	SWA	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Cw	Ccw	Cw	Ccw	Cw	Ccw	Cw	ccw	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	WHEN NO INPUT , ALL MOTORS DOES NOT RUNS
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	WHEN SELECTION BUTTON P ONLY PRESSES, THERE ALSO HAVE NO OUTPUT.
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	WHEN SELECTION BUTTON P AND A PRESS, AND ALL SENSOR '0',MOTOR4 START RUN CLOCK WISE
1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 10 PRESS,MOTOR1 START RUN CLOCK WISE
1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 2 PRESS,MOTOR2 START RUN CLOCK WISE
1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 5 PRESS,MOTOR3 START RUN CLOCK WISE
1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 7 PRESS,MOTOR4 START RUN COUNTER CLOCK WISE
1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 9 PRESS,MOTOR3 START RUN COUNTER CLOCK WISE
1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 4 PRESS,MOTOR2 START RUN COUNTER CLOCK WISE
1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 3 PRESS,MOTOR1 START RUN COUNTER CLOCK WISE
1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 1 PRESS,MOTOR4 START RUN COUNTER CLOCK WISE
1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	WHEN SELECTION BUTTON P AND A PRESS, AND SENSOR 10 PRESS, ALL MOTORS STOP

When SWITCH P presses, the system defined that drivers want to park the car.
Then if SWITCH A press, parking lot A was chosen as location to park the car. Motor4 start running in clockwise to clip the car.

While SENSOR10 sense the plate was moved the car, Motor1 start running in clockwise and Motor4 stop running. The operations of motor1 are to move the car in x-axis that is to define the column of the parking lot. Then, while

SENSOR2 was sense, Motor2 start running in clockwise and Motor1 stop running. Motor2 move the car up to the level of the parking lot.

When SENSOR5 was sensed, Motor3 start running in clockwise and Motor2 stop running. Motor3 moved the plate to define the row of the parking lot.

When SENSOR7 was sense, Motor4 start running in counter clockwise and Motor3 stop running. Motor4 release the car at the parking lot.

When SENSOR9 was sense, Motor3 start running in counter clockwise and Motor4 stop running. Motor3 move the plate back to center path.

When SENSOR3 was sense, Motor2 start running in counter clockwise and Motor3 stop running. Motor2 move the car down to lowest level.

When SENSOR4 was sense, Motor1 start running in counter clockwise and Motor4 stop running. Motor1 move the plate back to the entrance.

While SENSOR1 was sense, Motor1 stop running. Motor4 start running in counter clockwise While SENSOR10 was sense Motor4 stop running.

b) TAKING CAR AT PARKING LOT A

Table 2: Taking Car at Parking Lot A

Input											output								DESCRIPTION
user		sensor									M1		M2		M3		M4		
SWT	SWA	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Cw	Ccw	Cw	Ccw	Cw	Ccw	Cw	ccw	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	WHEN NO INPUT , ALL MOTORS DOES NOT RUNS
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	WHEN SELECTION BUTTON T ONLY PRESSES, THERE ALSO HAVE NO OUTPUT.
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	WHEN SELECTION BUTTON T AND A PRESS, AND ALL SENSOR '0',MOTOR4 START RUN CLOCK WISE
1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 10 PRESS,MOTOR1 START RUN CLOCK WISE
1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 2 PRESS,MOTOR3 START RUN CLOCK WISE
1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 5 PRESS,MOTOR2 START RUN CLOCK WISE
1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 7 PRESS,MOTOR4 START RUN COUNTER CLOCK WISE
1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 9 PRESS,MOTOR3 START RUN COUNTER CLOCK WISE
1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 4 PRESS,MOTOR2 START RUN COUNTER CLOCK WISE
1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 3 PRESS,MOTOR1 START RUN COUNTER CLOCK WISE
1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 1 PRESS,MOTOR4 START RUN COUNTER CLOCK WISE
1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	WHEN SELECTION BUTTON T AND A PRESS, AND SENSOR 10 PRESS, ALL MOTORS STOP

When SWITCH T pressed, the system defined that drivers want to park the car.

Then if SWITCH A pressed, parking lot A was defined as location to park a car. Motor4 start running in clockwise.

While SENSOR10 was sense the plate was to move the car, Motor1 start running in clockwise and Motor4 stop running. The operations of motor1 are to move the car in x-axis to define the column of the parking lot.

When SENSOR5 was sensed, Motor3 start running in clockwise and Motor1 stop running. Motor3 move the plate to define the row of the parking lot. Then, when SENSOR2 was sensed, Motor2 start running in clockwise and Motor3 stop running. Motor2 move the car up to the level of the parking lot.

When SENSOR7 was sensed, Motor4 start running in counter clockwise and Motor3 stop running. Motor4 release the car at the parking lot.

When SENSOR9 was sensed, Motor3 start running in counter clockwise and Motor4 stop running. Motor3 move the plate back to center path.

While SENSOR3 was sense, Motor2 start running in counter clockwise and Motor3 stop running. Motor2 move the car down to lowest level.

While SENSOR4 was sense, Motor1 start running in counter clockwise and Motor4 stop running. Motor1 move the plate back to the entrance. While SENSOR1 was sense, Motor1 stop running. Motor4 was start running in counter clockwise.

While SENSOR10 was sense Motor4 stop running

The switches are used to replace the sensors for the system .The sensors are inputs of the controller to define which motors want to run and stop. All the motors cannot run concurrently.

For each motor, there was supplied by PWM. This PWM can reduce the amount of power delivered to the DC motors to control the speed of the motors.

The Table3 has shown which motor can run clockwise, counter clockwise or stop while PWM, CW1, CCW1, CW2, CCW2, CW3 and CCW3 inputted to motors.

Table3: Motors setup

		MOTOR1		MOTOR		MOTOR3	
COMMENT	PWM	CW1	CCW1	CW2	CCW2	CW3	CCW3
ALL MOTORS STOP	0	0	0	0	0	0	0
MOTOR1 RUN COUNTER CLOCKWISE	1	0	1	0	0	0	0
MOTOR1 RUN CLOCKWISE	1	1	0	0	0	0	0
MOTOR2 RUN COUNTER CLOCKWISE	1	0	0	0	1	0	0
MOTOR2 RUN CLOCKWISE	1	0	0	1	0	0	0
MOTOR3 RUN COUNTER CLOCKWISE	1	0	0	0	0	0	1
MOTOR3 RUN CLOCKWISE	1	0	0	0	0	1	0

5.0 CONCLUSION

In conclusion, this is used for solve parking problems today. This Car park Allocation System is the parking system that allocated car automatically. This project can make easier to people to allocated car in the parking spot. It also reduces a time for searching parking spots to park a car. This parking system is suitable for the crowded areas especially shopping complex, apartments and campus.

6.0 FUTURE DEVELOPMENT

This Car park Allocation System is the embedded system that consists of microcontroller to control the motors movements. The input of this system is a switch as sensors. To improve the accuracy of the motors stopped at recommend distance, the infrared sensor is more suitable and efficient.

Besides that, to improve the security of this car park, smart electronic card is recommend as tickets or user account especially for reserved parking lots

7.0 ACKNOWLEDGEMENT

Alhamdulillah, in the name of god, unlimited thank to Allah the Almighty for giving me the strength, patient, persevere, confident and ability to complete this Car Park Allocation Systems project. Firstly, I would like to thank to my supervisor, Pn Nor Shahanim Binti Mohd Hadis for her support and supervision me for this two semester. She always willing to help and assist me as best as she can. Secondly, thank to my core supervisor, Prof Madya Kartini Binti Salam for her support and encouragement. Also thank to her for assisted me till the end of this project. Lastly, thank to all people involve and support me directly or indirectly until today. Thank you very much.

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